REMARKS

Applicants have carefully reviewed and considered the Examiner's Action mailed January 23, 2006, in which claims 56 and 61 were indicated as being allowable over the prior art of record if rewritten in independent form and to overcome the §112, second paragraph.. Reconsideration is respectfully requested in view of the comments set forth below.

By this Amendment, claims 44-46, 48, and 52-54 are amended. Accordingly, claims 44-61 are pending in the instant application.

Claims 44 and 49 were rejected under 35 U.S.C. §112, first paragraph as based on a disclosure that is not enabling as explained in paragraph 2 of the Action. By the foregoing amendments claims 44 and 49 are amended to recite that the phantom three-dimensional image comprises an aggregation of depth sampled images (i.e., images sampled in the depth direction, hereafter referred to as depth sampled images). In view of this amendment, it is respectfully submitted that claims 44 and 49 are enabled by the disclosure and withdrawal of the rejection under 35 U.S.C. §112, first paragraph is requested.

Claims 44-46, 49, and 54 were rejected under 35 U.S.C. §112, second paragraph as being indefinite for the reasons set forth in paragraph 4 of the Action. By the foregoing amendments to claims 44-46, 49 and 54, the indefinite areas identified have been addressed. With respect to claim 45, the shutter elements are divided [into regions] and each divided region is driven independently of other divided regions.

In order to facilitate the Examiner's understanding concerning the fundamental phantom technique, attached are three explanatory Figures (Figure 1, 2A, 2B). The

claimed invention provides an apparatus for reproducing a phantom image when a three-dimensional display device projects the phantom three-dimensional image. It is noted that the phantom three-dimensional image is comprised of an aggregation of 2D-phantom images (i.e. 2D-depth sampled images).

(1) First, as to the phantom three-dimensional image, for example, this image can be produced by using the three-dimensional display device providing a method for displaying the depth sampled images (i.e., images sampled in the depth direction). These depth sampled images can be defined as a two-dimensional image which is a portion of the three-dimensional image when the three-dimensional image is sampled in the depth direction by viewing from the eyes of an observer.

That is, in other words, the depth sampled images can be defined as the two-dimensional image which is a portion of the three-dimensional image that is divided as a divided depth sampled image according to a depth length in the depth direction. For example, when a plurality of depth lengths are set as depth lengths (d0<d1<.....<dn), these depth lengths are divided into portions such as a portion with length of above d0 below d1, a portion with length of above d1 below d2, and a portion with length of above dn-1 below dn.

(2) Thus, the divided depth sampled image according to the two-dimensional image as the phantom image can be displayed in sequence by varying the depth length in the depth direction for viewing the image, and thus projecting the three-dimensional image.

However, if the two-dimensional image according to the sampled portion of the three-dimensional image is displayed in sequence normally, a problem results where

portions such as an inside face and a cavity of a real object which should be shuttered and hidden from the observer's sight are allowed to be displayed. As a result, a phantom phenomenon occurs so that portions of the object which should be hidden are allowed to be viewed transparently.

In other words, the phantom three-dimensional image is defined as a three-dimensional image that allows the portions of the object which should be shuttered and hidden to be viewed inherently. The phantom images are defined as the portions of the object which should not be viewed and are displayed in error. Accordingly, an embodiment of the present invention is featured in how the phantom images, which are produced by projecting the depth sampled images, should be hidden.

(3) Explanatory Fig.1 is an example of a three-dimensional image (e.g., Volumetric) showing a depth sampling process in a depth direction.

Explanatory Fig.2A is an example of a real object showing that the observer can not view portions which should be hidden from an object closer to the observer's sight.

Explanatory Fig.2B is an example of 3-D depth sampled images showing that the observer can view portions which should be hidden from an object closer to the observer's sight, because obstacles are not existed in the depth direction.

As shown in Explanatory Fig.1, as to the depth sampling process, a three-dimensional object is divided and sampled in the depth direction to form an aggregation of a plurality of sampled images (i.e. two-dimensional images).

Then, the three-dimensional display is performed by rearranging the depth sampled images at the positions in the depth direction respectively.

As shown in Explanatory Fig.2A, the problem is that an object in a real world has

a function for diffusing and reflecting light on the surface of the object as well as a function for shuttering light from behind according to portions which should be hidden from an observer's sight (here, a transparent object is not included).

In contrast, as shown in Fig.2B, in the case of 3-D depth sampled images, obstacles for shuttering light do not exist in the depth direction and the observer can view light from behind according to portions which should be hidden. Accordingly, a phenomenon occurs where the portions of three-dimensional objects which should be hidden inherently are allowed to be viewed transparently. This phenomenon is called "a phantom phenomenon" in the field of a three-dimensional display technique. In view of the above explanation of the "phantom three dimensional display device", it is submitted that claims 44-46, 49 and 54 are fully definite under 35 U.S.C. §112, second paragraph and withdrawal of this rejection is respectfully requested.

Claims 44-46 are rejected under 35 U.S.C. §102(e) as being anticipated by U.S. Patent No. 5,828,487 to Greening et al. (hereinafter referred to as "Greening"). This rejection is respectfully traversed.

Greening discloses a viewing system (i.e. endoscope 10). In contrast, the claimed invention recites a three-dimensional display device which is totally different from Greening's technique in structural elements, as well as optical paths. Independent claim 44 recites a phantom three-dimensional display device for displaying a phantom three-dimensional image. As described above, the phantom three-dimensional image is comprised of an aggregation of phantom images (i.e. depth sampled images).

It is the Examiner's position that endoscope 10 of Greening meets the recited phantom three-dimensional display device that displays a phantom three-dimensional

image comprised of an aggregation of depth sampled images. Object 16 of Greening does not become a phantom three-dimensional image as recited in claim 44 when its rays pass through lenses. Object 16 is a real object and Greening does not disclose that a phantom image comprised of an aggregation of phantom images is displayed on the focusing lens 23 of camera 22. Thus, Greening does not disclose that, for example, a hidden portion such as a back side of the object is allowed to be viewed from an observer's sight. In contrast, the claimed invention discloses an apparatus for replacing a phantom image that is produced by displaying the aggregation of phantom images by a shutter device having a plurality of shutter elements for controlling light transmittance so that the shutter elements are arranged at positions where the depth sampled images are displayed in a depth direction and each of the shutter elements are controlled in a time division manner so as to vary the light transmittance. Greening fails to disclose the recited phantom three-dimensional display device and the shutter device having a plurality of shutter elements where each of the shutter elements are controlled in a time division manner as required by independent claim 44.

The Examiner considers an opaque leaf 30 of Greening as a shutter element. However, the light transmittance can be varied when the opaque leaf is used to adjust an open area of an aperture, and thus only a bundle of light can be narrower in Greening's system. That is, Greening discloses a technique where the entire amount of light only can be adjusted.

In contrast, the recited shutter elements of claim 44 are used for varying light transmittance in a plane (i.e., two-dimensional plane) and are not used for narrowing the bundle of light. The shutter elements can vary light transmittance at each position

according to the plane. Thus, when a texture (i.e., an image that is picked up in a plane) is located at a rear position of the plane, the shutter elements can vary the amount of light at the texture located the rear position of the plane. Greening's technique fundamentally is used for a two dimensional display system in which the bundle of light is focused and detected on a sensor element. That is, according to Greening's system, the brightness of light effectively can be varied. This is not the claimed invention: a three dimensional display system to vary the light transmittance by displaying the aggregation of phantom images as the depth sampled images in a time division manner (claims 44-46). The claimed invention is directed to a technology applicable to an apparatus for displaying a two-dimensional image on a display device in a three dimensional fashion (page 1, lines 11-17 and page 14, lines 17-24 of the present application).

The opaque leaf 30 of Greening is used so that the central portion of the texture can be viewed without the amount of light and the amount of light in the periphery of the texture is varied according to a distance from the central portion. The claimed invention recites a plurality of shutter elements that are used for varying a way of viewing the texture at the rear position of the plane, and thus the bundle of light is not narrowed but it is necessary to vary the amount of light transmittance at the positions of planes. respectively. Accordingly, Greening's opaque leaf is not the recited "shutter element" of the claimed invention as it does not obtain the advantageous result described above.

Consequently, Greening cannot anticipate claims 44-46 because it fails to disclose 1) a phantom three-dimensional display device for displaying a phantom three-dimensional image comprised of an aggregation of depth sampled images; and 2) shutter elements of a shutter device arranged at positions where the depth sampled images are

displayed in a depth direction and each of the shutter elements are controlled in a time division manner respectively so as to vary the light transmittance, as required in independent claim 44. It is well established patent law that a reference must disclose all recited features of a claim to anticipate the same. Greening fails to do this as argued above. Thus, the anticipation of independent claim 44 and dependent claims 45-46 should be withdrawn.

Claims 49-50 were rejected under 35 U.S.C. §102(e) as being anticipated by U.S. Patent No. 5,583,677 to Ito et al. (hereinafter referred to as "Ito") for the reasons set forth in paragraph 7 of the Action. This rejection is respectfully traversed.

Ito is directed to an optical compensation sheet and its fabrication as well as a liquid crystal display device using the same. Contrary to the Examiner's position, Ito does not disclose a technique for displaying a phantom three-dimensional image comprised of an aggregation of depth sample images, as required by independent claim 49. The most that Ito discloses is modulation of an incoming light. Ito does not disclose a number of phantom images that are sampled in the depth direction of the object to be displayed. Thus, Ito cannot anticipate claim 49 and its dependent claim 50 because it at least fails to disclose a phantom three-dimensional image comprised of an aggregation of depth sampled images. Withdrawal of the rejection to claims 49-50 is respectfully requested.

Claims 47-48 were rejected under 35 U.S.C. §103(a) as being unpatentable over Greening and further in view of U.S. Patent No. RE 37,219 to Takahara et al. (hereinafter referred to as Takahara) and U.S. Patent No. 5,047,847 to Toda et al. (hereinafter referred to as "Toda") as explained in paragraph 8 of the Action. This rejection is respectfully

traversed.

As argued above, Greening does not disclose a technique for displaying a phantom three-dimensional image and thus there is no reason why one of ordinary skill in the art would incorporate a technique for replacing a phantom image as the recited shutter elements of the shutter device vary the light transmittance. According to the claimed invention, the phantom three-dimensional image is comprised of an aggregation of phantom images (i.e. depth sampled images). Therefore, the claimed invention is totally different from Greening's technique in structure of the system. In addition, a system for displaying the phantom three-dimensional image can not be produced, even if Greening technique's is combined with the technologically different techniques taught by Takahara and Toda.

Takara is directed to a method of fabricating a polymer dispersed liquid crystal panel with measuring thickness, adjusting then hardening. The Examiner suggests modifying Greening to include a liquid crystal display as taught by Takahara for the opaque leaf of Greening. It is unclear why one of ordinary skill in the art would replace an opaque leaf with an LCD and even if they were combined Takahara does not provide the features missing from Greening as argued above.

Toda is directed to an endoscope using liquid crystal devices having different response frequencies of the molecular orientation so that the transmittivity and refractive index of the plurality of liquid crystals may be independently controlled by varying the frequency of the driving signal applied to the liquid crystal assembly. Thus, Toda does not disclose 1) a phantom three-dimensional display device for displaying a phantom three-dimensional image comprised of an aggregation of depth sampled images; and 2)

shutter elements of a shutter device arranged at positions where the depth sampled images are displayed in a depth direction and each of the shutter elements are controlled in a time division manner respectively so as to vary the light transmittance that are missing from Greening.

Further, as described above, the claimed shutter elements are different from Greening's opaque leaf. The recited shutter elements allow light transmittance to be varied at a plane which cannot be produced by narrowing the bundle of light (e.g., by using an opaque leaf), and thus the light in a texture at a rear position of the plane can be varied. Finally, even one of ordinary skill in the art were motivated to modify the opaque leaf to the recited shutter elements and adjustment can be performed so that the amount of light as a whole remains the same value, it is not anticipated that a real image (i.e., a phantom three-dimensional image) would be projected at the positions of shutter elements and light transmittance of images (i.e., textures) at planes located behind the projected plane can be varied, as achieved by the claimed invention.

Claims 52 and 53 were rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 5,880,883to Sudo for the reasons set forth in paragraph 9 spanning pages 8-9 of the Action. This rejection is respectfully traversed.

Sudo discloses an apparatus for displaying an image recognized by an observer as a stereoscopic image and image pick-up apparatus. The technique disclosed by Sudo allows an image to be focused on a display of an image display apparatus. In contrast, the claimed invention set forth in claim 52 is different from Sudo in that it is controlled so that images **are focused on the positions in the depth position for displaying depth sampled images** (see the description on page 131, lines 2 to line 18 of the present

application). Sudo does not disclose, teach or suggest a control device that controls the display and optical devices so that the focal lengths of the optical device are focused on the positions of the depth sampled images, as required by independent claim 52.

Sudo does not disclose the recited feature of claim 53 where a control device controls a deflection device so that a display image of a two-dimensional display device approaches toward the center position between the right and left eyes when the depth position of the display image of the two-dimensional display device approaches closer to the right and left eyes. That is, the optical system for the one side eye of Sudo does not include the variable focal lens device and thus it is impossible to perform the control of the control device as required by claim 53. Accordingly, Sudo fails to disclose, teach or suggest the claimed inventions set forth in claims 52 and 53 and withdrawal of this rejection is respectfully requested.

Claims 54, 55 and 58-60 were rejected under 35 U.S.C. §103(a) as being unpatentable over Sudo and further in view of U.S. Patent No. 5,299,037 to Sakata as explained in paragraph 10 spanning pages 9-10 of the Action. This rejection is respectfully traversed.

Claim 54 has been rewritten in independent form and includes all of the limitations of amended claim 52. Sakata does not disclose, teach or suggest a control device that controls the display and optical devices so that the focal lengths of the optical device are focused on the positions of the depth sampled images, as required by independent claim 54. Instead, Sakata is directed to a diffraction grating type liquid crystal display device in viewfinder and is not concerned with controlling the focal lengths of the optical device to be focused on the positions of the depth sampled images,

as required by claim 54. Accordingly, claim 54 and its depending claims 55 and 58-60 are not rendered obvious by this combination of references. Withdrawal of the rejection to claims 54-55 and 58-60 is respectfully requested.

Claim 57 was rejected under 35 U.S.C. §103(a) as being unpatentable over Sudo in view of Sakata and further in view of Takahara as explained in paragraph 11 of the Action. This rejection is respectfully traversed.

Claim 57 depends from claim 54 and therefore includes all of the features of that claim. As argued above, Sudo in view of Sakata at least fail to disclose, teach or suggest a control device that controls the display and optical devices so that the focal lengths of the optical device are focused on the positions of the depth sampled images, as required by independent claim 54. Takahara is concerned with the method of fabricating a polymer dispersed liquid crystal panel and does not provide the teaching missing from Sudo in view of Sakata. Accordingly, claim 57 is not rendered obvious by this combination of references and withdrawal of this rejection is respectfully requested.

In view of the foregoing amendments and remarks, it is respectfully requested that the rejections of record be withdrawn and that a Notice of Allowance be issued indicating that claims 1-4 and 7-12 are allowed over the prior art of record.

Should the Examiner believe that a conference would advance the prosecution of this application, the Examiner is encouraged to telephone the undersigned counsel to arrange such a conference.

Respectfully submitted,

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